Numeric Nutrient Criteria Implementation Discussion Piece

Preface

The purpose of this meeting is to discuss possible approaches for the implementation of numeric nutrient criteria (NNC), and is intended to be exploratory in nature. The meeting is not intended to reach any final decisions, but rather the goal is to discuss options that might be acceptable to both USEPA (Region 2 and Headquarters) and NYSDEC.

Introduction

Nutrient-related water quality impacts are confounded by several issues, including the *indirect nature* of many of the adverse impacts to designated use(s) and *inherent natural variability* in stressor-response relationships. Thus, it is essential that the application of NNC be done within a framework and context of these realities. One scientifically defensible approach to addressing these factors in the application of NNC is to exploit confidence and/or prediction bands associated with regression relationships between stressor and response variables.

Proposed Approach

It is proposed that nutrient-related management actions could be implemented within the context of natural variability of stressor-response relationships as defined by regression relationship(s) and associated confidence/prediction bands. Incidentally, the proposed approach is quite similar to an approach being suggested by USPEA in Florida, and it would be beneficial to compare and contrast these constructs – see below.

The stressor-response relationship (e.g., total phosphorus and chlorophyll) and associated confidence/prediction bands offer a number (8 in all) of discrete "management boxes" once a given response threshold is defined – see Figure 1. Referring to Figure 1, the boxes or scenarios are as follows:

Scenarios w/ Ambient Response Variable Below Response Threshold

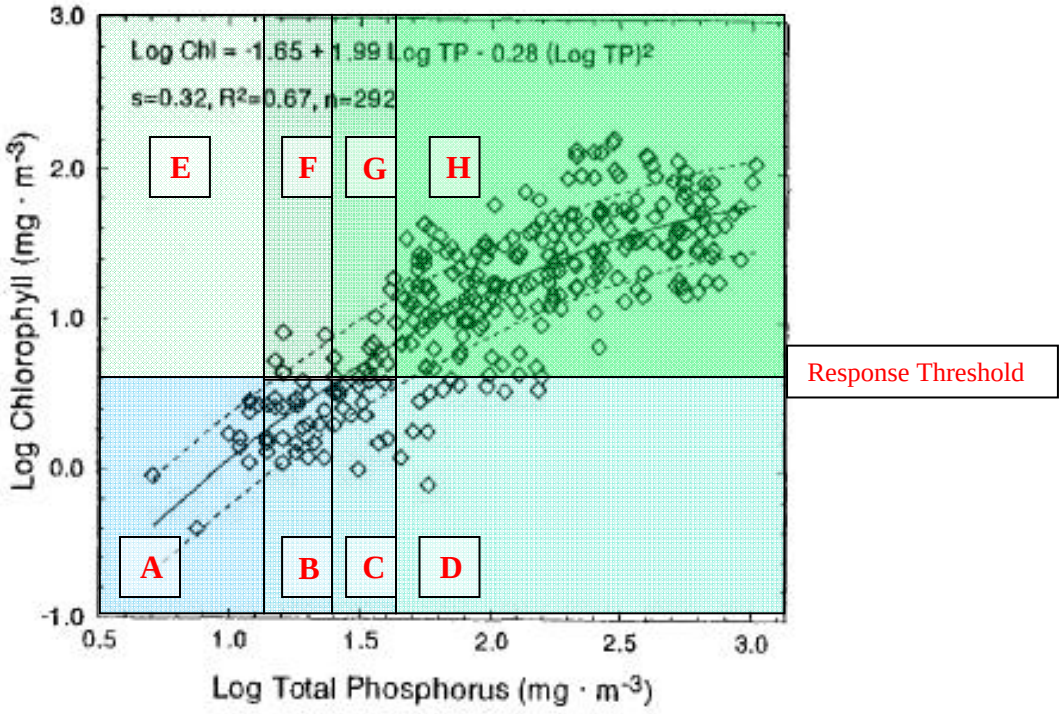
(A) ambient response concentration below response criteria threshold and ambient stressor concentration below that defined by upper confidence band; (B) ambient response concentration below response criteria threshold and ambient stressor concentration above that defined by upper confidence band but below that defined by best fit; (C) ambient response concentration below response criteria threshold and ambient stressor concentration above that defined by best fit but below that defined by lower confidence band; (D) ambient response concentration below response criteria threshold and ambient stressor concentration above that defined by lower confidence band;

Scenarios w/ Ambient Response Variable Above Response Threshold

(E) ambient response concentration above response criteria threshold and ambient stressor concentration below that defined by upper confidence band; (F) ambient response concentration above response criteria threshold and ambient stressor concentration above that defined by upper confidence band but below that defined by best fit; (G) ambient response concentration above response criteria threshold and ambient stressor concentration above that defined by best fit but below that defined by lower confidence band; (H) ambient response concentration above response criteria threshold and ambient stressor concentration above that defined by lower confidence band.

Figure 1: Adapted from Van Nieuwenhuyse & Jones (1996)

Fig. 2. Log–log relation between mean total phosphorus concentration and mean chlorophyll concentration among streams (eq. 1). Dashed curves approximate 65% confidence interval for individual predicted values.



Listing

Basic approach as follows: (a) if the ambient response metric is ***below*** the response threshold waterbody segment is considered ***supporting*** designated use – note some nuance with categories C & D; (b) if the ambient response metric is ***above*** the response criteria threshold the waterbody segment is consider ***not supporting*** designated use and is listed on 303(d) list – note nuance with respect to relevant portion of 303(d) list.

Table 4.1: Impairment listing scenario matrix

Total Phos./Chl-a Status	Chl-$a_{(A)}$ < Chl-*a* Criteria	Chl-$a_{(A)}$ > Chl-*a* Criteria
$TP_{(A)} < TP_{(UC)}$	**A**: Fully support w/re. nutrients	**E**: 303(d) Part 3b; target = TBD
$TP_{(UC)} < TP_{(A)} < TP_{(BF)}$	**B**: Fully support w/re. nutrients	**F**: 303(d) Part 3b; target = TBD
$TP_{(BF)} < TP_{(A)} < TP_{(LC)}$	**C**: Fully support w/re. nutrients (WI/PWL threatened)	**G**: 303(d) Part 1; target = $TP_{(BF)}$
$TP_{(A)} > TP_{(LC)}$	**D**: Fully support w/re. nutrients (WI/PWL stressed)	**H**: 303(d) Part 1; target = $TP_{(BF)}$

$TP_{(A)}$: Ambient total phosphorus concentration
$TP_{(LC)}$: Lower confidence band threshold concentration
$TP_{(UC)}$: Upper confidence band threshold concentration
$TP_{(BF)}$: Best fit (regression) threshold concentration
Chl-$a_{(A)}$: Ambient chlorophyll-*a* concentration
TBD: To be determined based upon further study

Permitting/TMDLs

It is proposed that permitting decisions would be bifurcated whereby new permits (with nutrient loads) and permit modifications (involving nutrient load increases) would be handled through one set of scenarios, while permit renewals (without change in nutrient load) would be handled under a somewhat different set of scenarios.

The general approach would be as follows: (a) if the ambient response variable is below the response criteria the segment would be deemed to *have remaining assimilative capacity* with respect to target stressor and available capacity would be defined as the next higher stressor target (e.g., upper confidence band target, best fit target, or lower confidence band target); Note revision - Assimilative Capacity for Boxes C & D considered tapped out (b) if the ambient response variable is above the response criteria the segment would be deemed to be *exceeding the assimilative capacity* with respect to target stressor and the TMDL target would be to either the next lower stressor target (e.g., upper confidence band target, best fit target) or the best-fit target, whichever is lower.

New Permits

Table 4.3: Matrix for new permits and permit modifications with nutrient load expansion

Total Phos./Chl-a Status	Chl-$a_{(A)}$ < Chl-*a* Criteria	Chl-$a_{(A)}$ > Chl-*a* Criteria
$TP_{(A)} < TP_{(UC)}$	**A**: $TP_{(UC)}$ = target	**E**: WQAC endpoint = TBD
$TP_{(UC)} < TP_{(A)} < TP_{(BF)}$	**B**: $TP_{(BF)}$ = target	**F**: WQAC endpoint = $TP_{(UC)}$
$TP_{(BF)} < TP_{(A)} < TP_{(LC)}$	**C**: $TP_{(BF)}$ = target; Cap & Mon.	**G**: WQAC endpoint = $TP_{(BF)}$
$TP_{(A)} > TP_{(LC)}$	**D**: $TP_{(BF)}$ = target; Cap & Mon.	**H**: WQAC endpoint = $TP_{(BF)}$

WQAC: water quality assimilative capacity
$TP_{(A)}$: Ambient total phosphorus concentration
$TP_{(LC)}$: Lower confidence band threshold concentration
$TP_{(UC)}$: Upper confidence band threshold concentration
$TP_{(BF)}$: Best fit (regression) threshold concentration
Chl-$a_{(A)}$: Ambient chlorophyll-*a* concentration
TBD: To be determined based upon further study

Permit Renewals

Table 4.4: Matrix for permit renewals *without* nutrient load increase

Total Phos./Chl-a Status	Chl-$a_{(A)}$ < Chl-*a* Criteria	Chl-$a_{(A)}$ > Chl-*a* Criteria
$TP_{(A)} < TP_{(UC)}$	**A**: no action necessary	**E**: TMDL endpoint = further study
$TP_{(UC)} < TP_{(A)} < TP_{(BF)}$	**B**: no action necessary	**F**: $TP_{(UC)}$ = TMDL endpoint
$TP_{(BF)} < TP_{(A)} < TP_{(LC)}$	**C**: Cap & Monitor	**G**: $TP_{(BF)}$ = TMDL endpoint
$TP_{(A)} > TP_{(LC)}$	**D**: Cap & Monitor	**H**: $TP_{(BF)}$ = TMDL endpoint

$TP_{(A)}$: Ambient total phosphorus concentration
$TP_{(LC)}$: Lower confidence band threshold concentration
$TP_{(UC)}$: Upper confidence band threshold concentration
$TP_{(BF)}$: Best fit (regression) threshold concentration
Chl-$a_{(A)}$: Ambient chlorophyll-*a* concentration